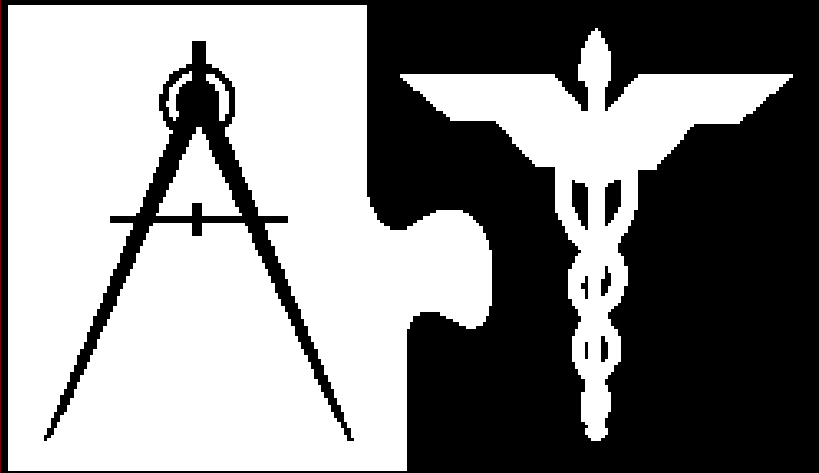
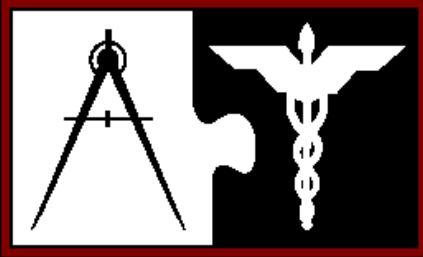


SAN DIEGO CIREN

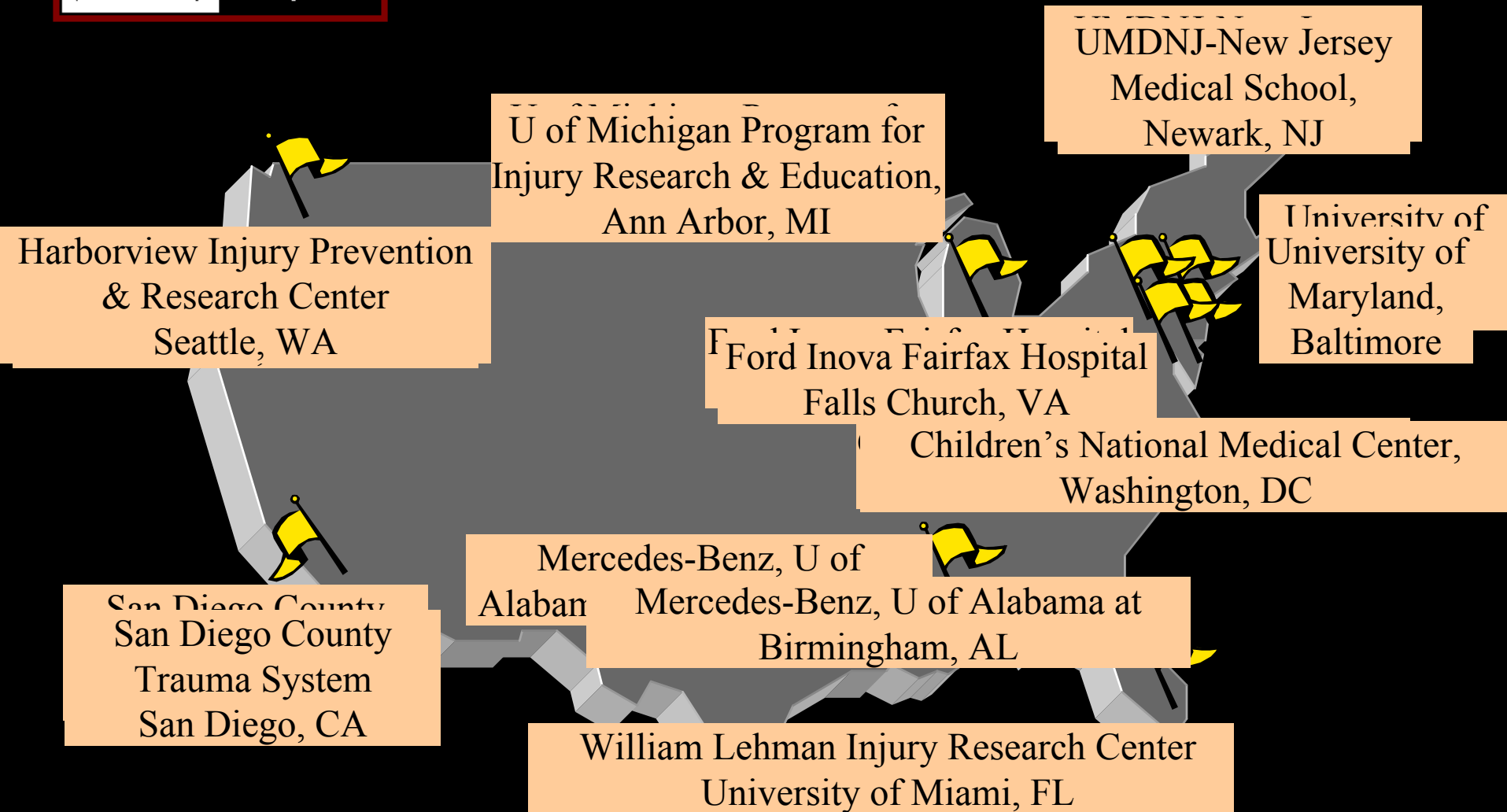


June 21, 2001

Washington, DC



CIREN Network





San Diego CIREN Program Principal Investigators



Gail F. Cooper

A. Brent Eastman, MD, FACS

David B. Hoyt, MD, FACS



San Diego CIREN Program



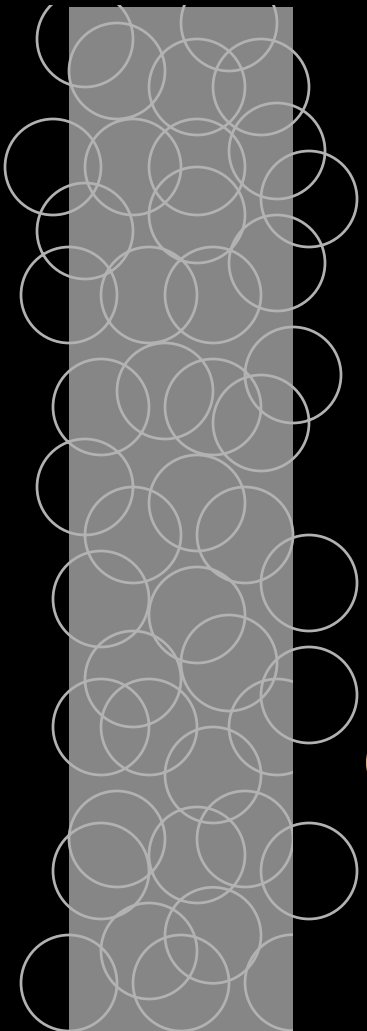
Sharon E. Pacyna

Steve Erwin

Teresa Vaughan



San Diego CIREN Centers

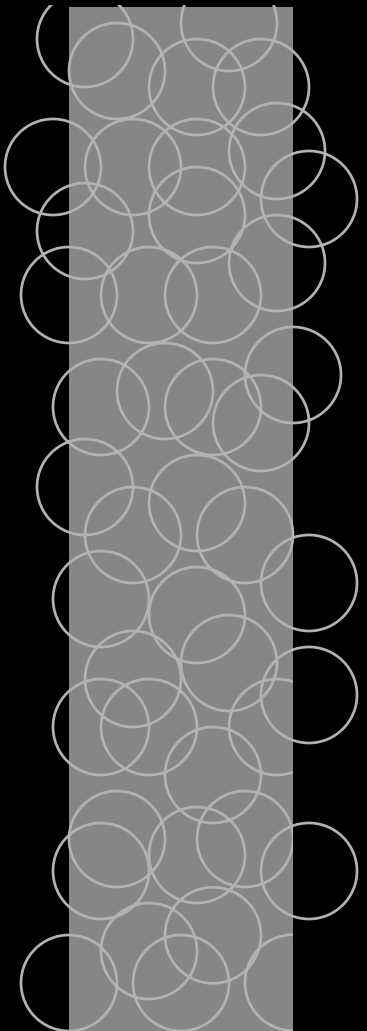


Children's Hospital
Palomar Medical Center
Scripps Memorial Hospital - La Jolla
Scripps Mercy Hospital
Sharp Memorial Hospital
UCSD Medical Center, San Diego

County of San Diego, Emergency Medical Services

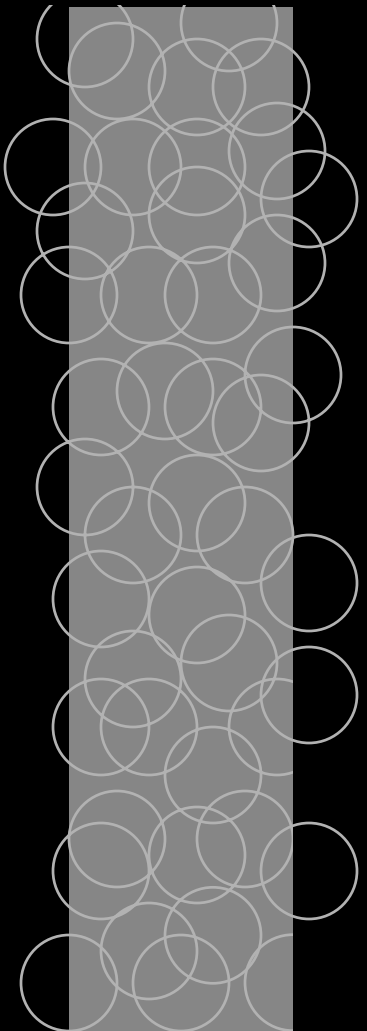


Today's Topics

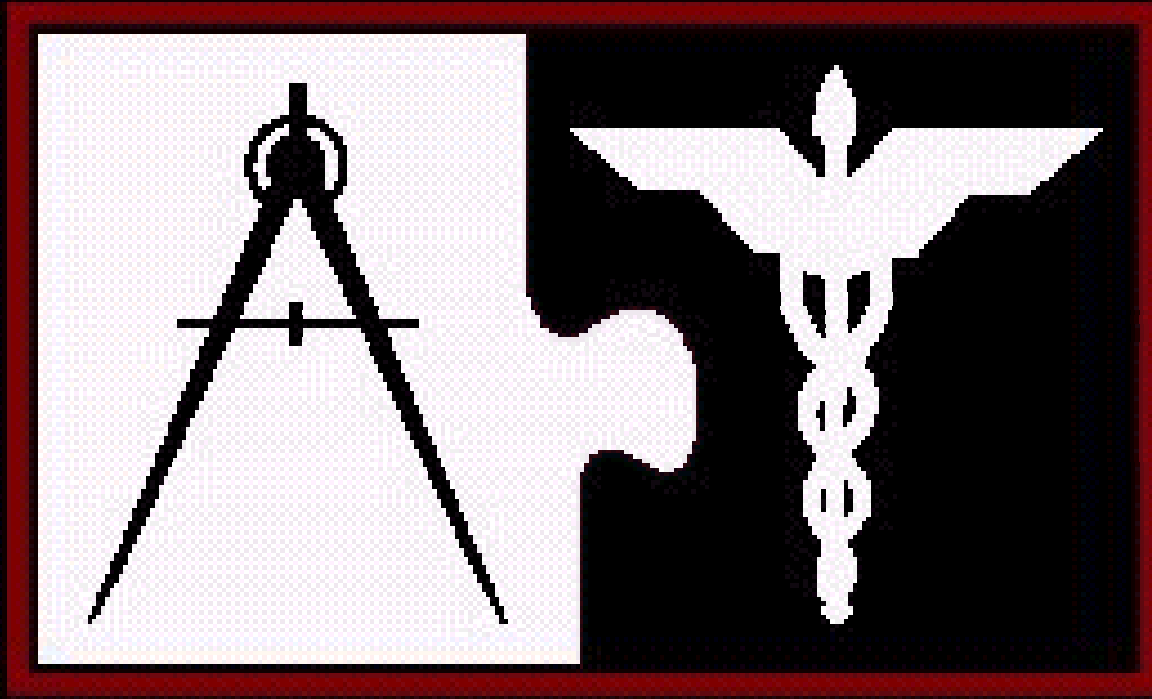
- 
- ◆ What is CIREN
 - ◆ CIREN Goals
 - ◆ Identifying Potential CIREN Candidates
 - ◆ Crash Basics
 - ◆ Occupant Kinematics
 - ◆ Injury Documentation
 - ◆ CIREN “Pearls” & “Perils”



The San Diego CIREN Research Project

- 
- ◆ NHTSA funded
 - ◆ Investigate frontal and side impacts meeting certain inclusion criteria
 - ◆ Vehicle inspection and scene documentation
 - ◆ Injury Documentation
 - ◆ Occupant Kinematics
 - ◆ Injury Sourcing/Biomechanical Analysis

Emergency Department Personnel



Piecing It Together



CIREN Goals



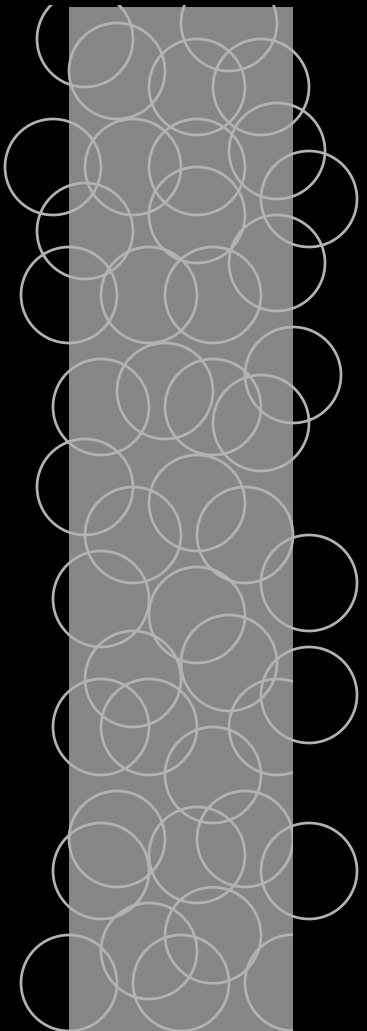
Injury Control

Injury Control

Injury Control



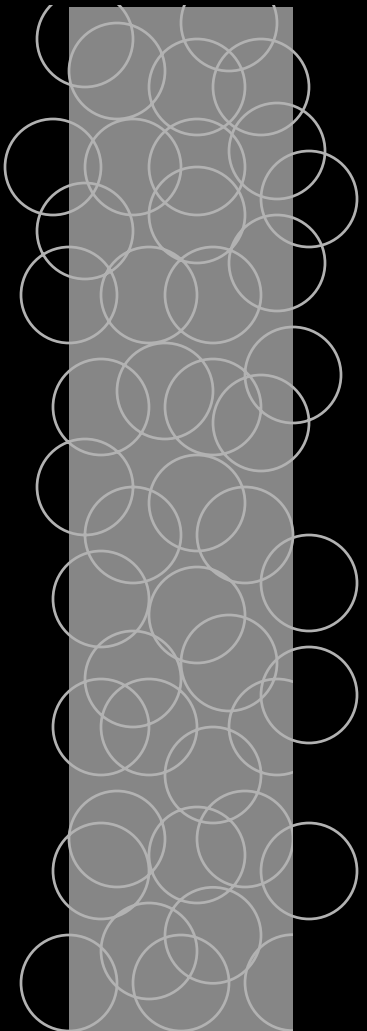
We Need the E.D. !!

- 
- ◆ Finding CIREN Patients
 - ◆ Record Crash Events
 - ◆ Document Bruises



Finding Patients

Inclusion Criteria

- 
- ◆ Adult Frontal Impact
 - ◆ Adult Side Impact
 - ◆ Pediatric Frontal Impact
 - ◆ Pediatric Side Impact
 - ◆ Researcher's Principal Interest

CIREN Inclusion Criteria

Adult Occupants

Frontal Impact

- ◆ Late Model Year (LMY)
 - current year minus 6
- ◆ AIS 3 or AIS 2 (foot & ankle)
- ◆ Belt and/or Airbag
- ◆ Front seat only
- ◆ Success Stories

Side Impact

- ◆ FMVSS 214
 - Any LMY SUV/PU
- ◆ AIS 3 or AIS 2 (foot & ankle)
- ◆ No restraint necessary
- ◆ Any seat position
- ◆ Success Stories

CIREN Inclusion Criteria

Pediatric Occupants

Frontal Impact

- ◆ Late Model Year (LMY)
- ◆ Admitted with AIS 1+ (front seat) or AIS 2+ (back seat)
- ◆ CRS, Belt and/or Airbag
- ◆ Success Stories

Side Impact

- ◆ FMVSS 214
- ◆ Admitted with AIS 2+ - any seat position
- ◆ No restraint necessary
- ◆ Success Stories

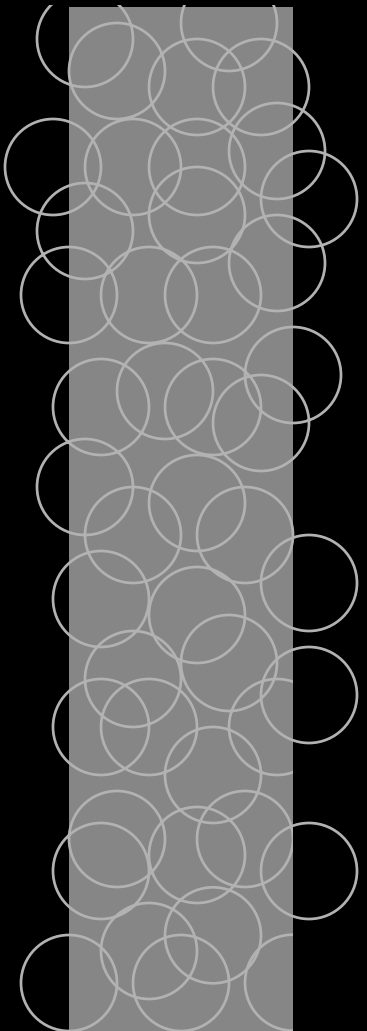


Inclusion Criteria - in a nutshell

- 
- ◆ Year of Vehicle
 - ◆ Occupant Position
 - ◆ Type of Crash
 - ◆ Seat Belt Use
 - ◆ Airbag Deployment
 - ◆ AIS

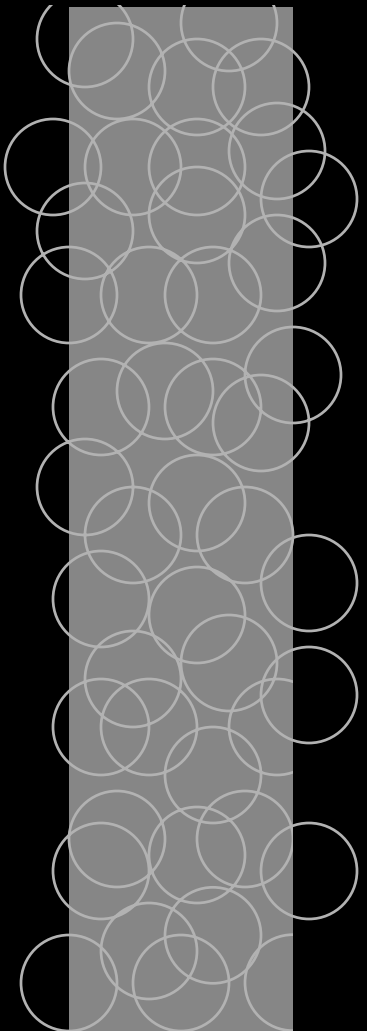


Identifying Potential CIREN Candidates

- 
- ◆ QA Runs
 - ◆ Trauma Nurse Managers/Researchers
 - ◆ Interface with Medical Examiner



San Diego County QANet

- 
- ◆ Wide Area Network
 - ◆ Live on-line system
 - ◆ Provides medic run information
 - ◆ Programmed, for CIREN, to identify all patients transported to Trauma Centers
 - ◆ Basic run information - used as a tool for patient identification

MICN Run Sheet

Run #387654.0	Incident Date: 6/20/2001	Time: 0133	Base: UCSD
PARAMEDICS			
Calling Agency: Rural Metro		Unit 0006	
Crew Member #1: P1999		Crew Member #2: 2344	
Age: 34	Sex: M	Weight: 150 lbs 75 kg	Chief Complaint Category: Trauma: Extremities Acuity: Moderate
CHIEF COMPLAINT			
Restrained driver of SUV head on into telephone pole at high rate of speed. Prolonged extrication. CC severe right leg pain and deformity of left ankle. Brief LOC			
INITIAL VITALS			
Time: 0148	Pulse: 110	Respiration: 24	Temperature: Blood Pressure: 90/64 EKG: ST Ectopy: None Unk
P Q R S T			
Provoked:	Quality:	Region:	Scale: Duration:
PQRST Narrative:			
B R I M			
Breathing/Condition: Shallow Verbal Response: Confused Eyes-Response: Spont Movement Response: MAE			
Brim Narrative: Oriented to person only, + LOC, gross deformity of left leg			
Mechanism of Injury: MVA Auto/Truck Driver		Comorbid Factors: ETOH	
Anatomical Factors: Blunt-Extremity	Protective Measures: Airbag/Lap/Shoulder	Trauma: Major	
PHYSICAL FINDINGS			
Capillary Refill:<2sec	Chest:Tender Rt chest	Abdomen:Normal/Neg	
Motor/Neuro Response:Normal	Description:Moves ext	Up/L: Up/R: Lwr/L: Lwr/R:	
Eyes: Left PERL Right PERL	Lungs: Left clear Right clear		
SKINS-Color: Pale	Moisture: Clammy	Temperature: Cool	
GLASCOW (Eyes: 4 + Verbal: 4 + Motor: 6) = Score 14		REVISED TRAUMA (GCS:4 + Respiration:4 + Systolic:3) = Score 11	
CRAMS (Circulation:2 + Respiration:2 + Abdomen:1 + Motor:2 + Speech:1) = Score 8			

Sample QA Run

CIREN.R2

Report.Sc

vs. 06/98

San Diego County

Automotive Crash Study Daily Log

Receiving Hosp:

Date: 9/02/98

Page: 2

Incident Date:

Incident Date&Time	QANet#	Calling Agency /Transporting	Patients Name (Last,First)	Seat Postion	Age	Sex	Restraints	Disc/ F Admit	Admit/DC	Crash Type	Crash Model	Crash Make	I, E P, X
		Escondido Fire Department /Escondido Fire Department		P Unk	45Y	F	LAP & SHOULDER	DIS					E
		Escondido Fire Department /Escondido Fire Department		Driver	25Y	F	LAP & SHOULDER	ADM		Unknown			
		Escondido Fire Department /Escondido Fire Department		Driver	70Y	F	LAP & SHOULDER	DIS		Side			E
		American Med Response ALS /American Med Response ALS		Driver	49Y	F	LAP & SHOULDER	ADM		Frontal			
		American Med Response ALS /American Med Response ALS		Bk Seat	22Y	M	LAP & SHOULDER	ADM					
		American Med Response ALS /American Med Response ALS		Driver	19Y	M		DIS					E
		American Med Response ALS /American Med Response ALS		P Unk	19Y	M	LAP & SHOULDER	DIS		Side			E
		Escondido Fire Department /Escondido Fire Department				M	SHOULDER	DIS					E
		Escondido Fire Department /Escondido Fire Department		FR	34Y	M	UNRESTRAINED	ADM					E
		Vista Fire Department /Vista Fire Department		FR	20Y	M	LAP & SHOULDER	DIS		Side			E
		Vista Fire Department /Vista Fire Department		Driver	18Y	M	LAP & SHOULDER	ADM		Side			

Admit/DC

Restraints

Seat Position

Crash Type

Admit/DC

Restraints

Seat Position

Crash Type

Incident Date:

Incident Date/Time	Calling Agency /Transporting	Patient's Name (Last, First)	Sex	Age	Restraints	Disch/ Admit	Filling AIS	Crash Type	Car Model & Make	Y
	Escondido Fire Department /Escondido Fire Department		P	UNK	49Y	F	LAP & SHOULDER	ADM		E
	Escondido Fire Department /Escondido Fire Department		Driver	25Y	F	LAP & SHOULDER	ADM	Unknown	1987 Volvo	E
	Escondido Fire Department /Escondido Fire Department		Driver	40Y	F	LAP & SHOULDER	DIS	Side		E
	American Med Response ALS /American Med Response ALS		Driver	49Y	F	LAP & SHOULDER	ADM	Frontal		E
	American Med Response ALS /American Med Response ALS		DA Seat	72Y	M	LAP & SHOULDER	ADM	Frontal		E
	American Med Response ALS /American Med Response ALS		Driver	19Y	M		DIS			E
	American Med Response ALS /American Med Response ALS		P Unk	19Y	M	LAP & SHOULDER	DIS	Side		E
	Escondido Fire Department /Escondido Fire Department		P Unk	86Y	M	SHOULDER	DIS			E
	Escondido Fire Department /Escondido Fire Department		FR	44Y	M					E
	Vista Fire Department /Vista Fire Department		FR	40Y	M	LAP & SHOULDER	DIS	Side		E
	Vista Fire Department /Vista Fire Department		Driver	46Y	M	LAP & SHOULDER	ADM	Side	NON FMVSS 214	E

Year of Vehicle

AIS

Exclusion/Inclusion

Annual San Diego County Trauma Services Report

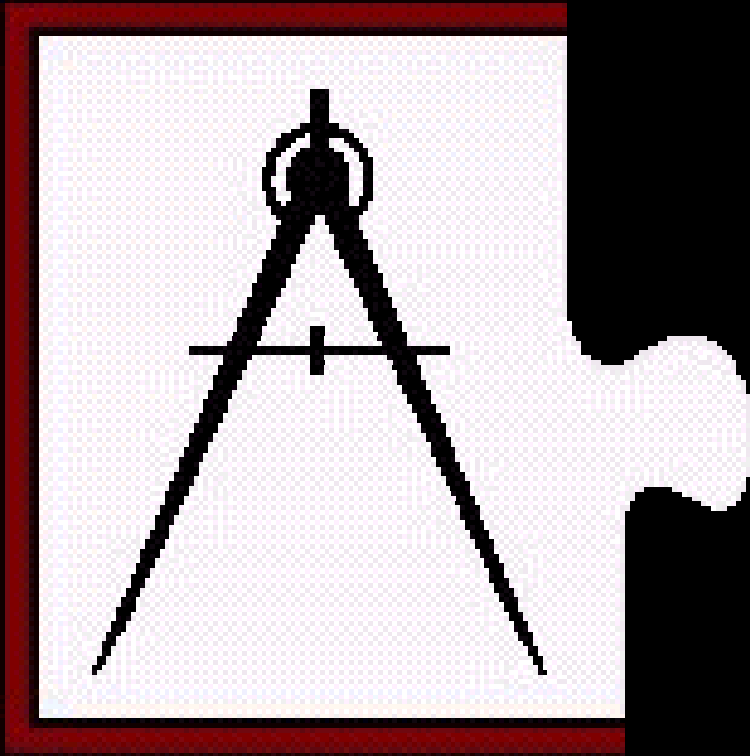
Occupant exclusions	5989
Occupant inclusions	48
Potential inclusions	0

For the occupants definitely excluded from the study, the exclusion criteria were categorized in the following descending order:

Minor Injury Patients	4758	79.45%
D/C from ED	3377	71%
Inappropriate AIS	1381	29%
Unrestrained Patients	331	5.53%
Crash Type Exclusions	358	5.98% (196 Rear impacts/ 162 Rollovers]
Vehicle not a LMY	200	3.34%
Crash in Mexico/Out of County	32	0.53%
Back Seat Occupant (in frontal crash)	7	0.12%
Not a FMVSS 214 (Side impacts)	2	0.03%
Unable to Locate/Contact Patient	68	1.14%
Consent Issues	40	0.67%
Unusual Crash Circumstances	14	0.23%
Language Barrier	11	0.18%
Ejected	37	0.62%
AMA	31	0.52%
Unknown year of vehicle	12	0.20%
Reason Undocumented	71	1.19%
Miscellaneous	17	0.28% ()

Total	5989	100.00%
--------------	-------------	----------------

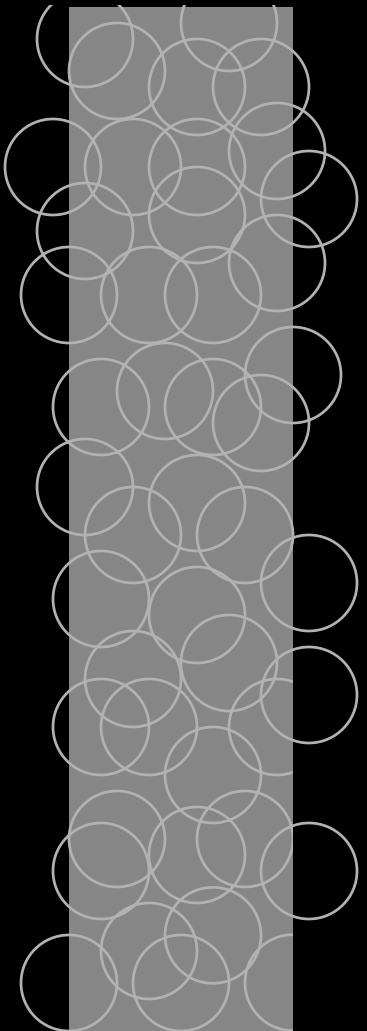
Basic Crash & Engineering Concepts

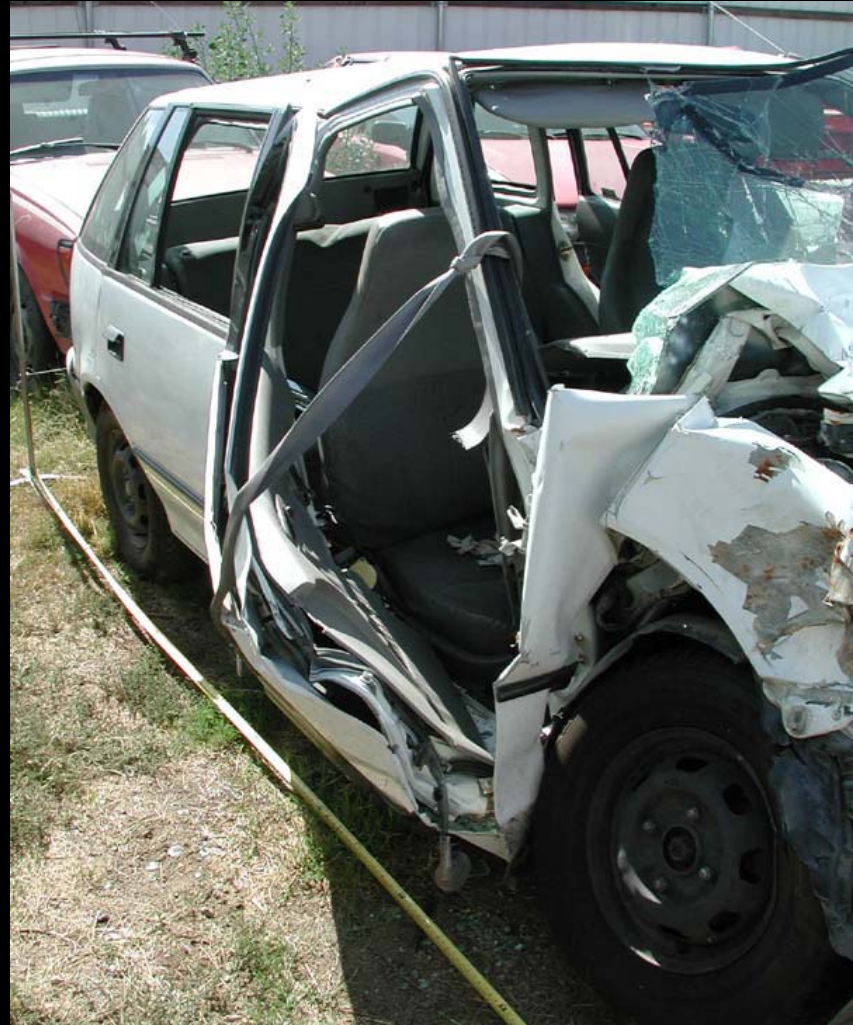


- ◆ Vehicle Safety Standards
- ◆ Vehicle Reconstruction



The Basic Basics

- 
- ◆ Vehicles designed to absorb energy of crash
 - Crumple zones for frontal crashes
 - Reinforced steel for side crashes



94 Geo Metro

2001 Honda Civic EX





The Basic Basics



Deformation & Intrusion

- ◆ Indicators of crash severity
- ◆ Indicators of energy management
- ◆ Indicators of potential injury





Not All Cars Are Created Equal



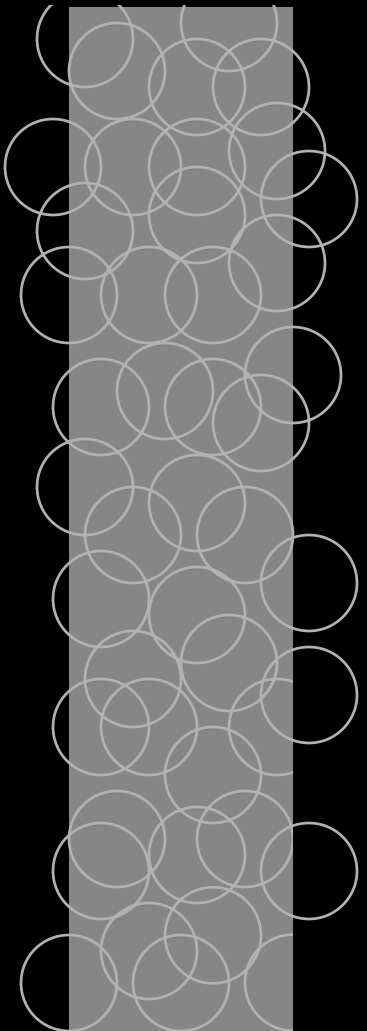
- ◆ OLD vs. NEW

- ◆ LIGHT vs. HEAVY

- ◆ SHORT vs. TALL



Crash Terminology

- 
- ◆ Compare Apples to Apples
 - DELTA V
 - Principal Direction Of Force

Delta V

- ◆ Measurement Of Speed Change At Impact
- ◆ Is proportional to the sum of all the forces experienced in a collision.
- ◆ Reliable measure of the forces in a crash and can predict injury severity
- ◆ Crash Severity Indicator
- ◆ Indicator of Injury Exposure

Comparing ΔV in a car crash to other injury mechanisms

Delta V

Equivalent Height

◆ 10 mph

3.5 feet

◆ 15 mph

7.5 feet

◆ 20 mph

13 feet - 1 story

◆ 25 mph

21 feet - 2 stories

◆ 30 mph

30 feet - 2.5 stories

◆ 35 mph

41 feet - 3.5 stories

◆ 40 mph

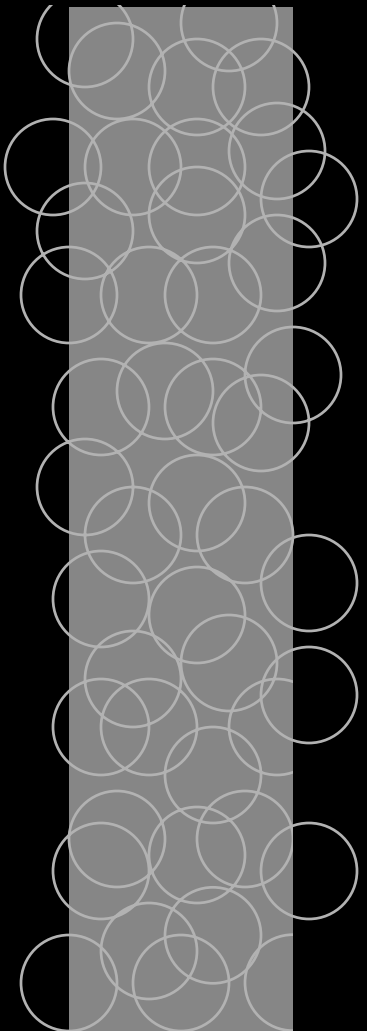
54 feet - 4.5 stories








Principal Direction of Force & Occupant Kinematics

- 
- ◆ Directional Measurement Of Vehicle Crush
 - ◆ Movement within the Vehicle


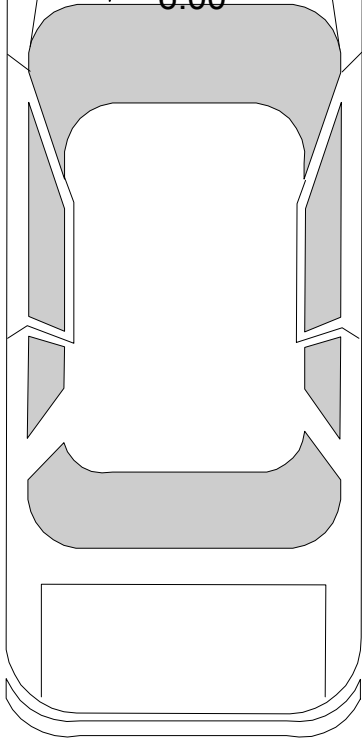
PDOF
and how it influences

Occupant Kinematics

Applied To Point
Of Impact



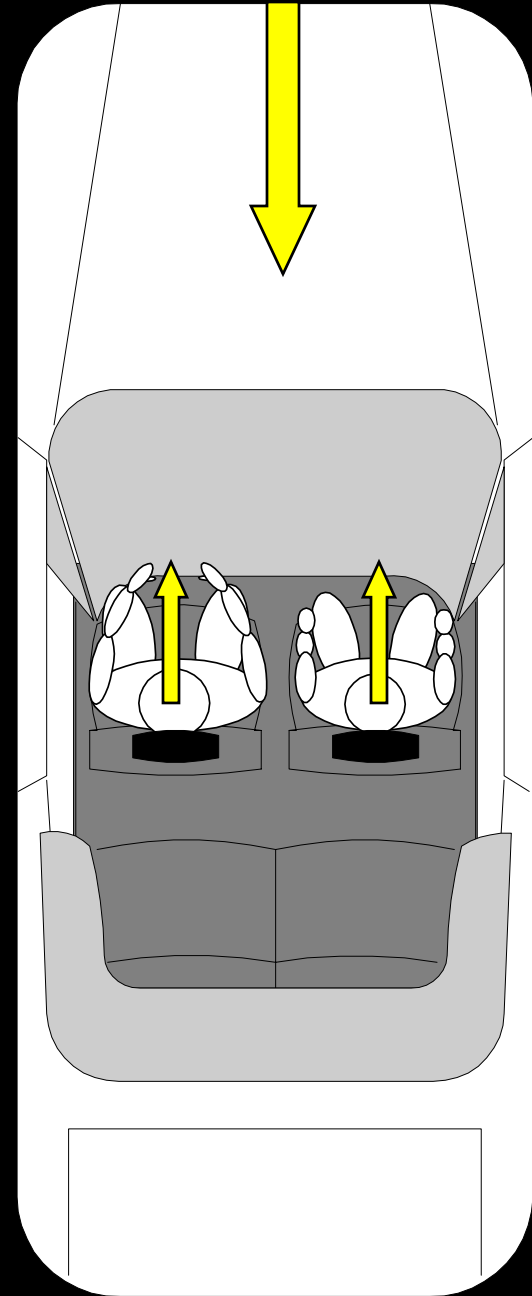
Measured In
Degrees



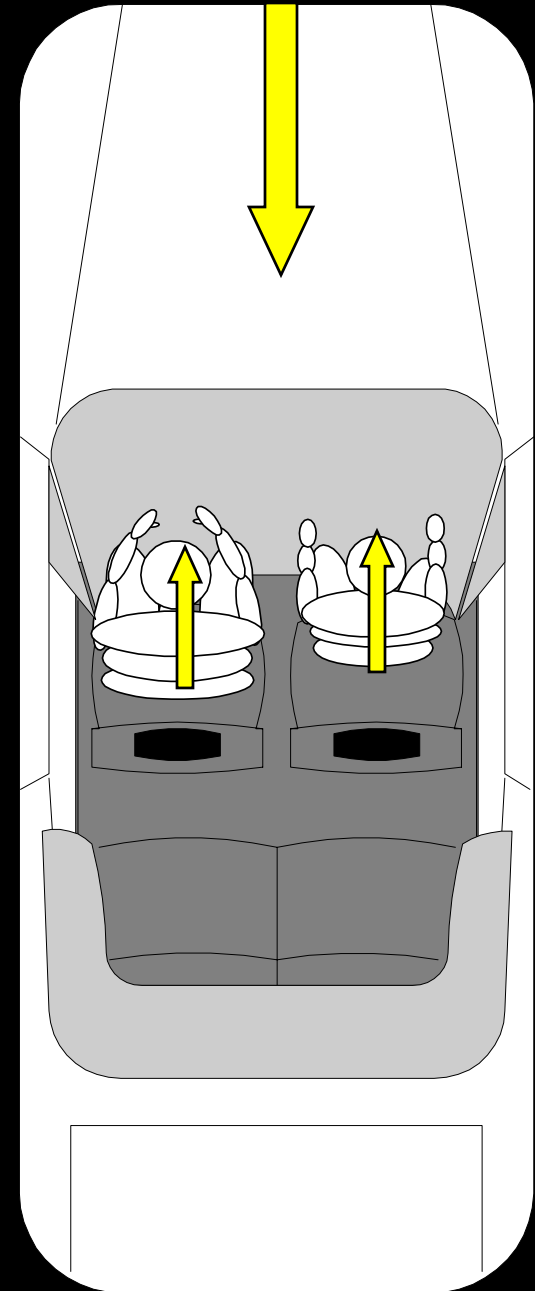
Corresponds To
Clock Face

Zero PDOF

In a full frontal crash



Occupants move
opposite and parallel





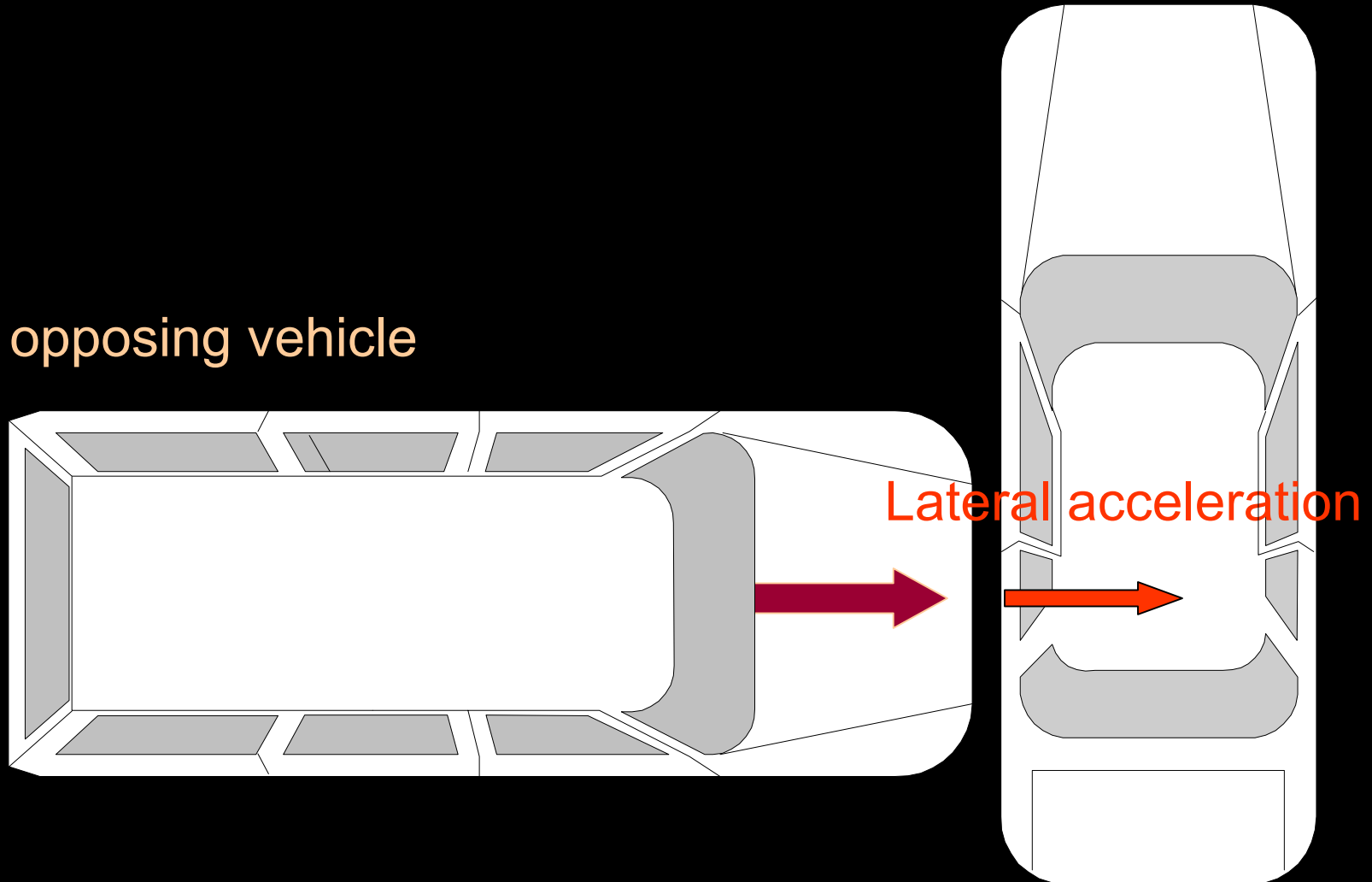


THE FOLLOWING 30 MPH FRONTAL
BARRIER IMPACT TEST WAS CONDUCTED
UNDER THE CONTRACT WITH THE NATIONAL
HIGHWAY TRAFFIC SAFETY ADMINISTRATION
BY MGA RESEARCH CORPORATION
BURLINGTON, WISCONSIN

Subject Vehicle Not In Motion

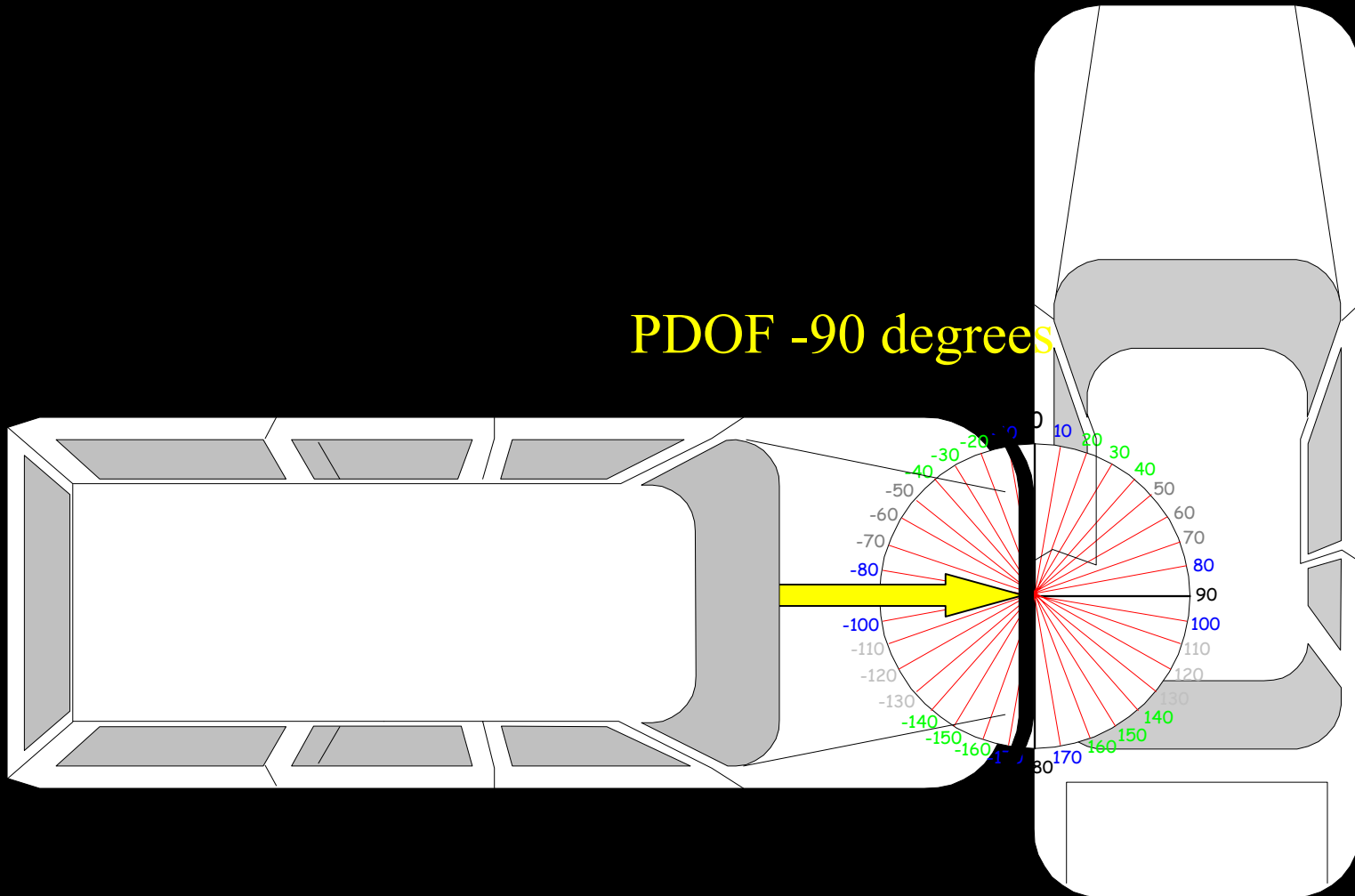
subject vehicle

opposing vehicle



Subject Vehicle Not In Motion

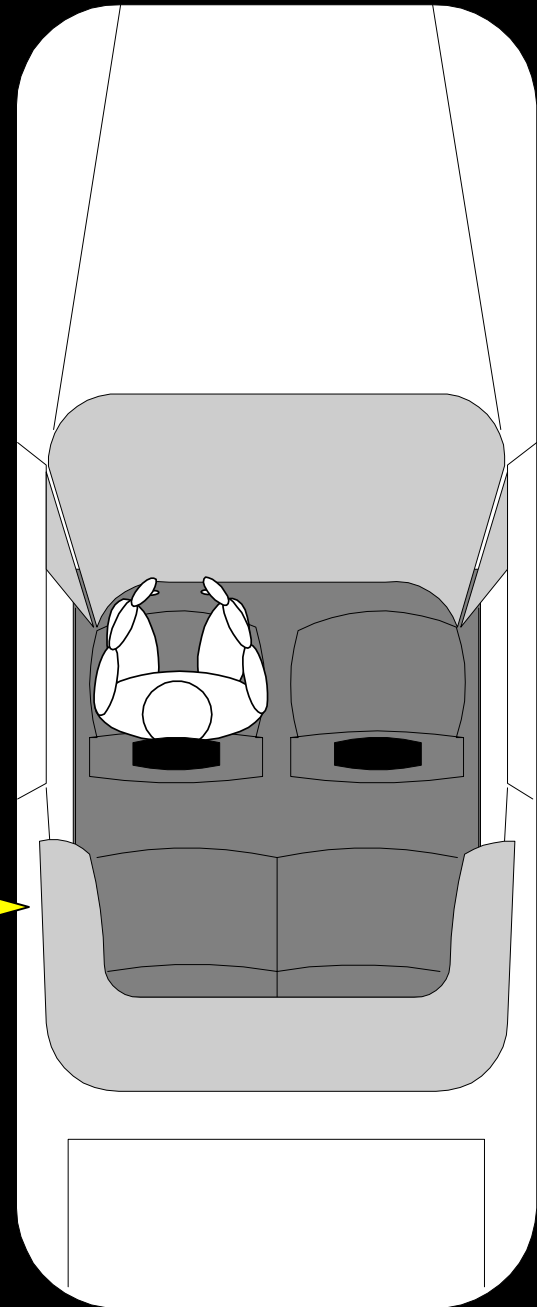
Subject Vehicle



Subject Vehicle Not In Motion

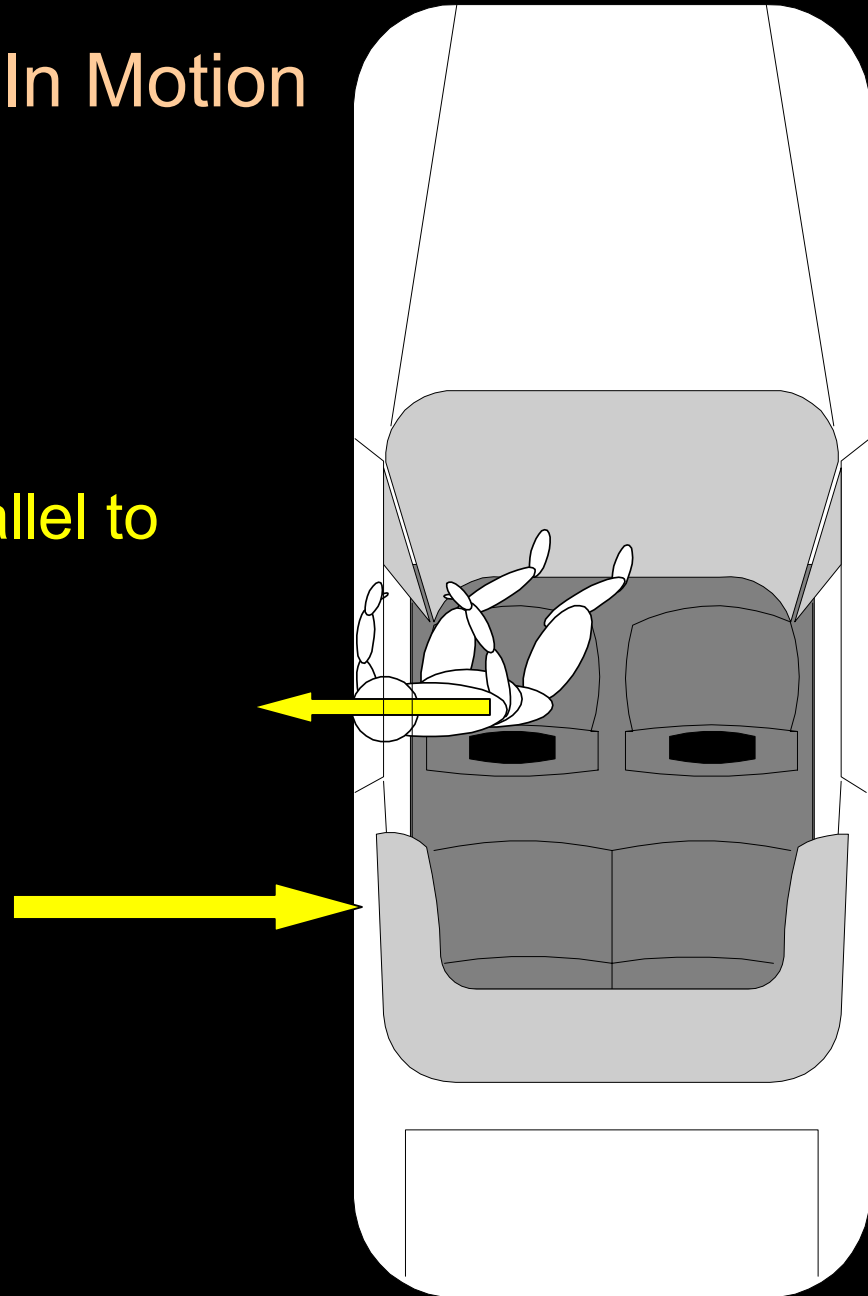
Occupant moves...

-90 degree PDOF



Subject Vehicle Not In Motion

...opposite and parallel to
PDOF

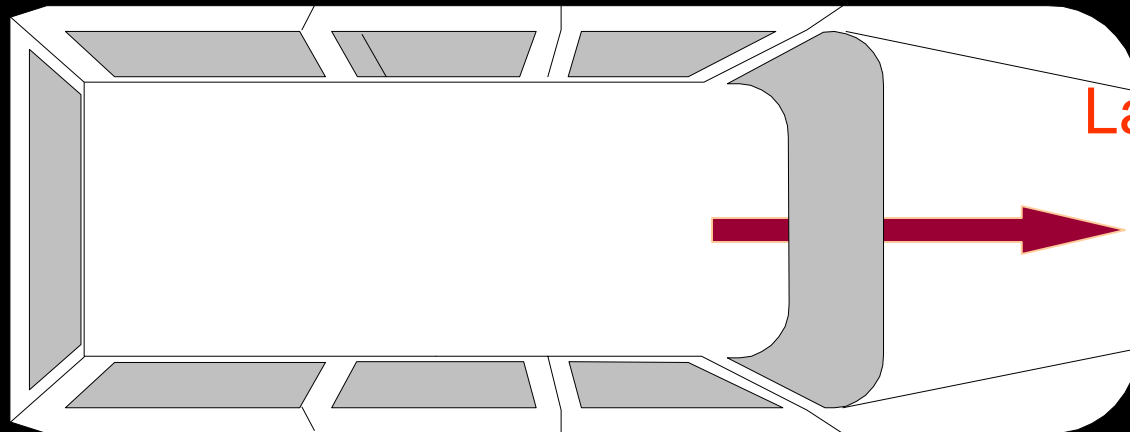




Subject Vehicle In Motion

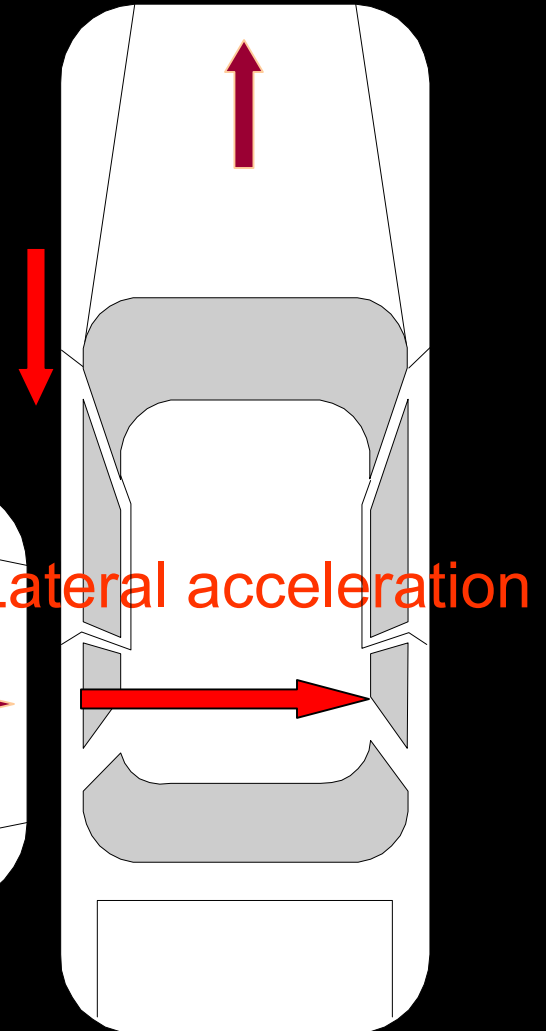
Because the subject vehicle has forward motion
it also has

rearward deceleration



Opposing vehicle

Subject Vehicle



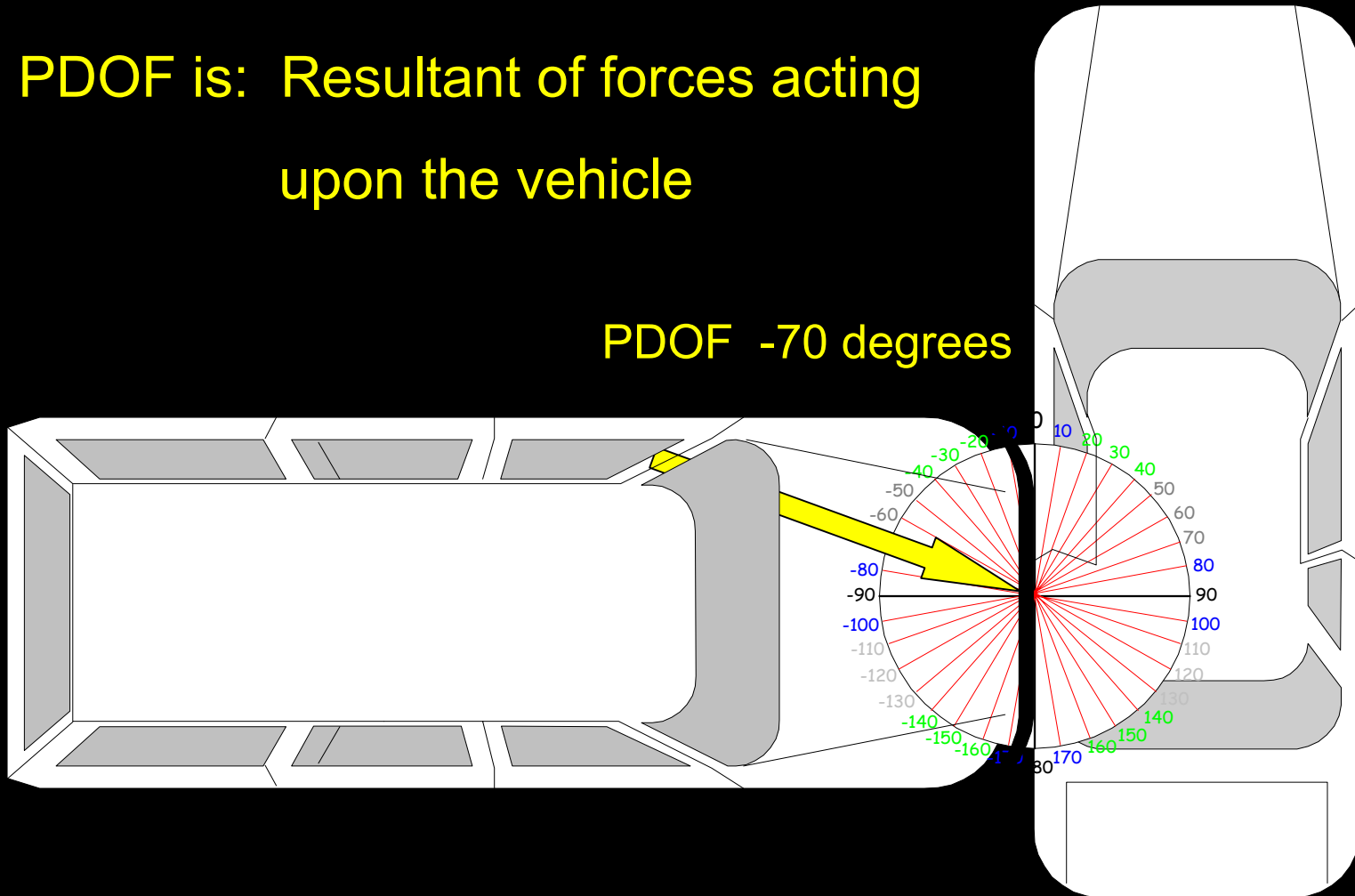
Lateral acceleration

Subject Vehicle In Motion

Subject Vehicle

PDOF is: Resultant of forces acting upon the vehicle

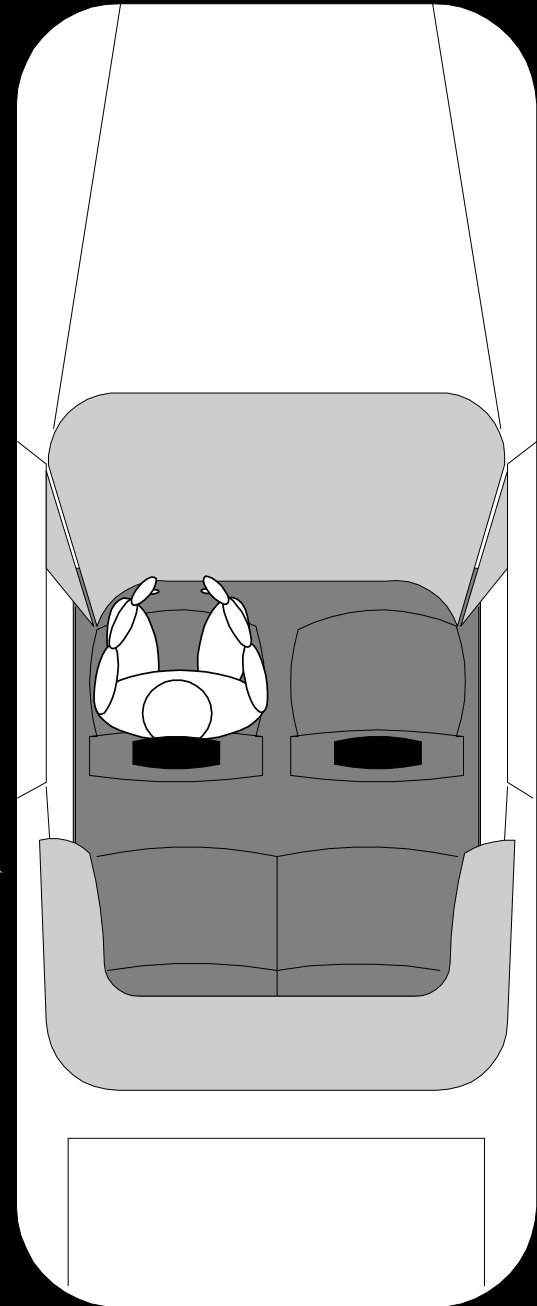
PDOF -70 degrees



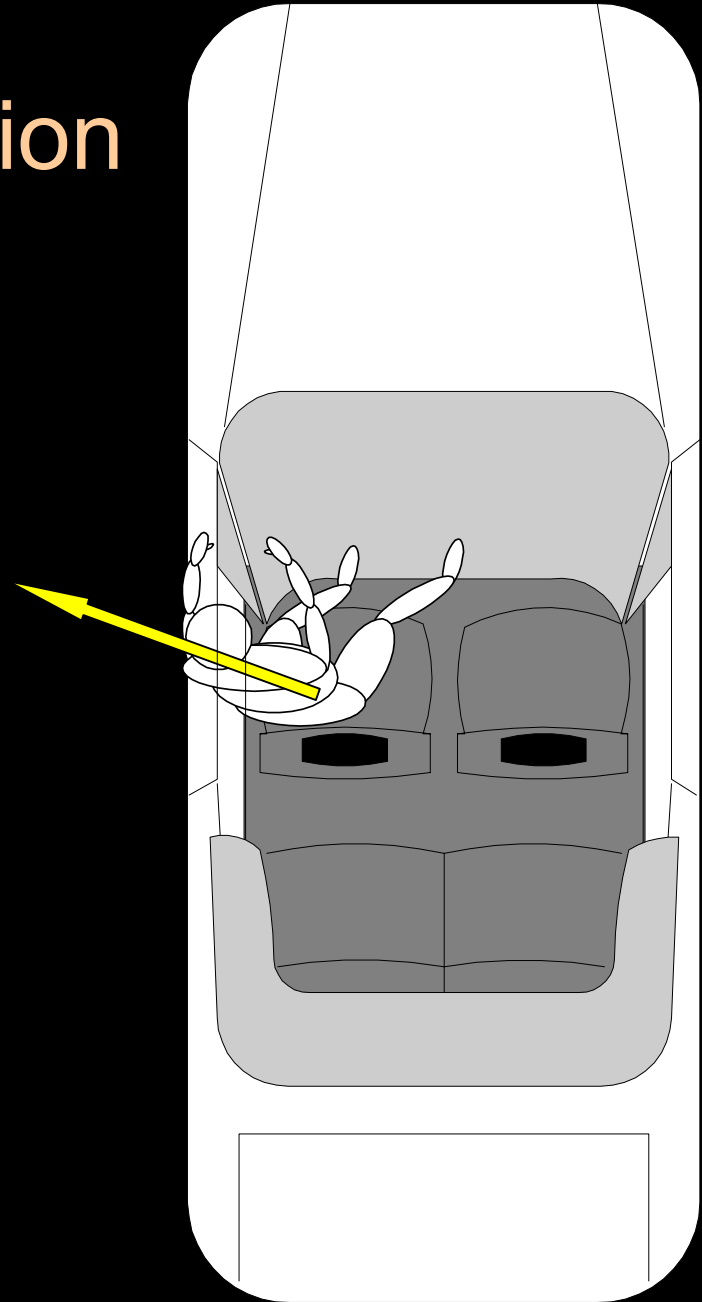
Subject Vehicle In Motion

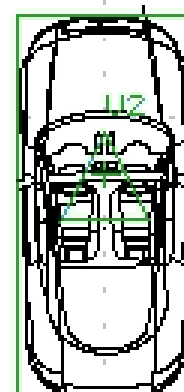
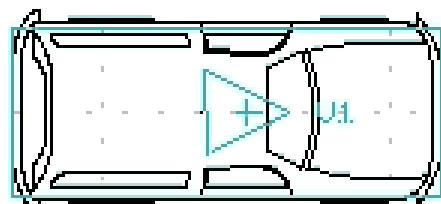
Opposite and parallel to PDOF

-70 degree PDOF



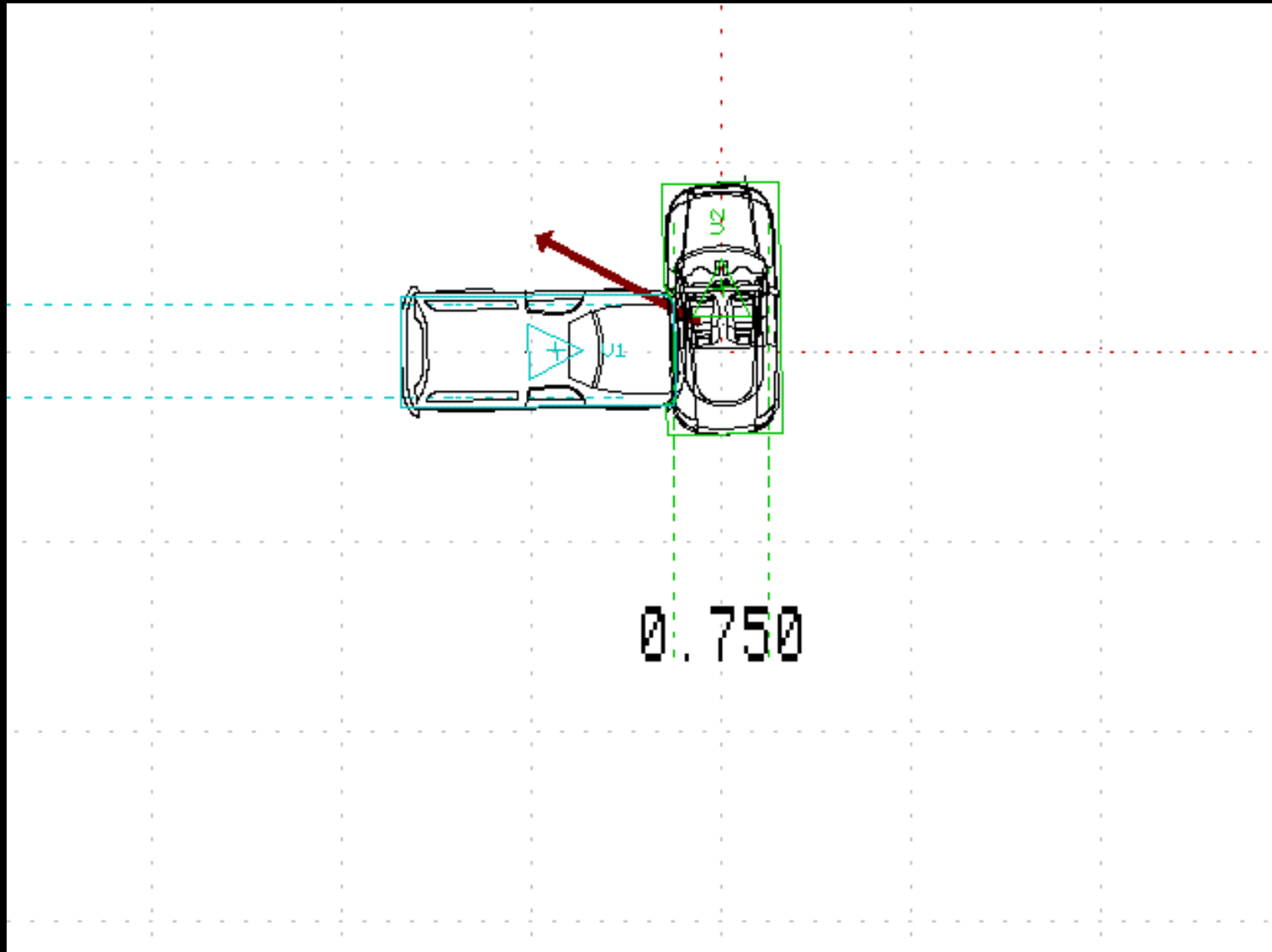
Subject Vehicle In Motion



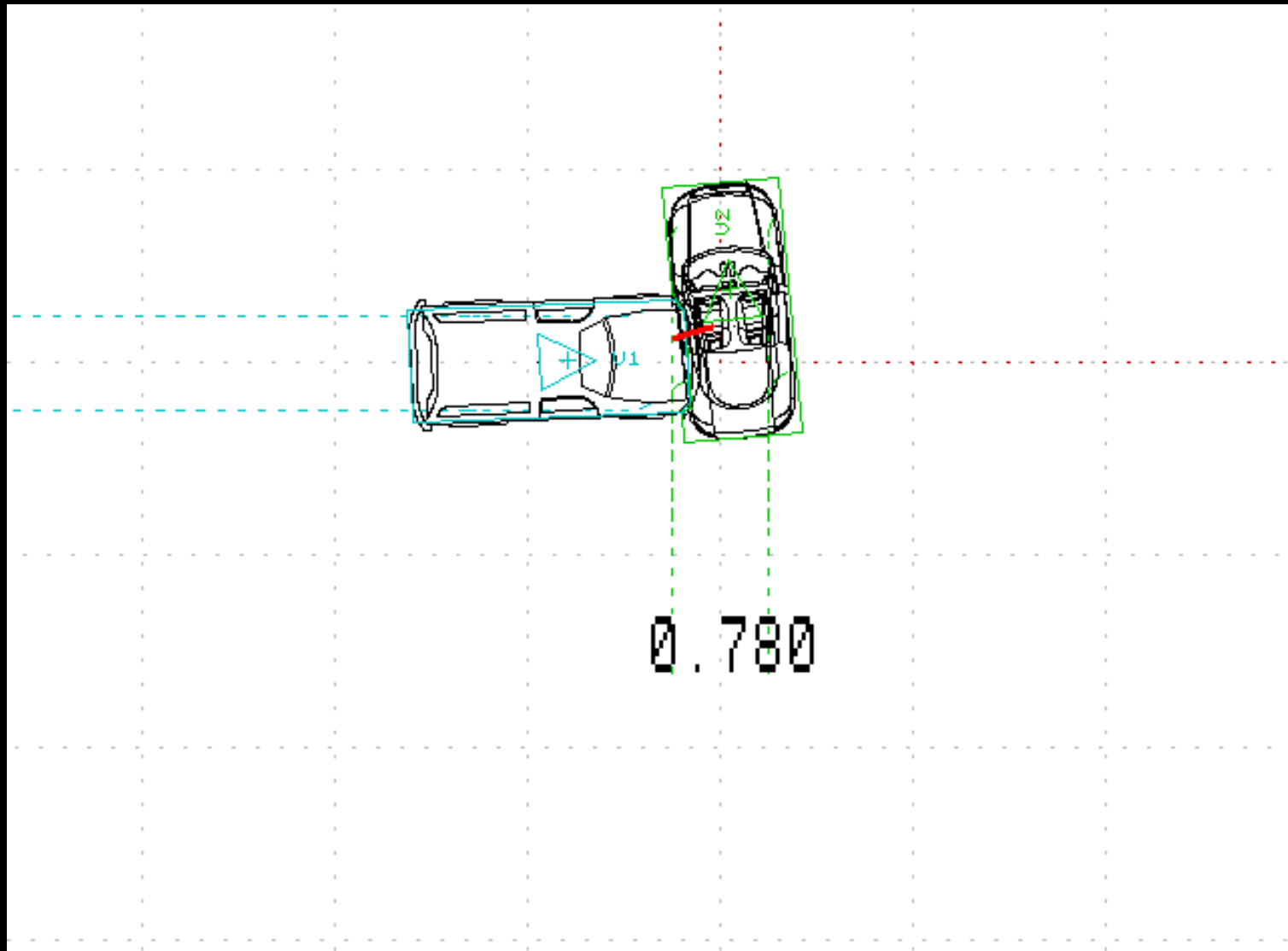


0.000

Primary Occupant Motion Vector



Secondary Occupant Motion Vector



INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

2000 Buick LeSabre
Frontal Offset Crash Test
Deformable Barrier
64.3 kph (39.9 mph)
40 Percent Overlap
CF99015
June 24, 1999

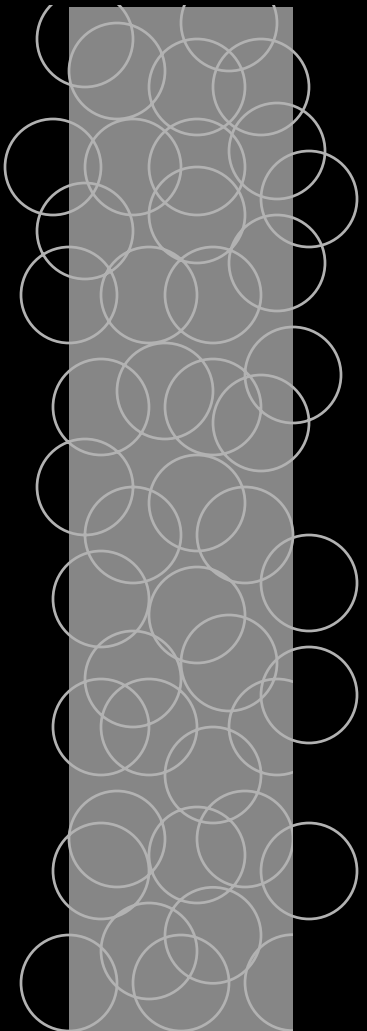


We Need the E.D. !!

- 
- ◆ Finding CIREN Patients
 - ◆ Record Crash Events
 - ◆ Document Bruises

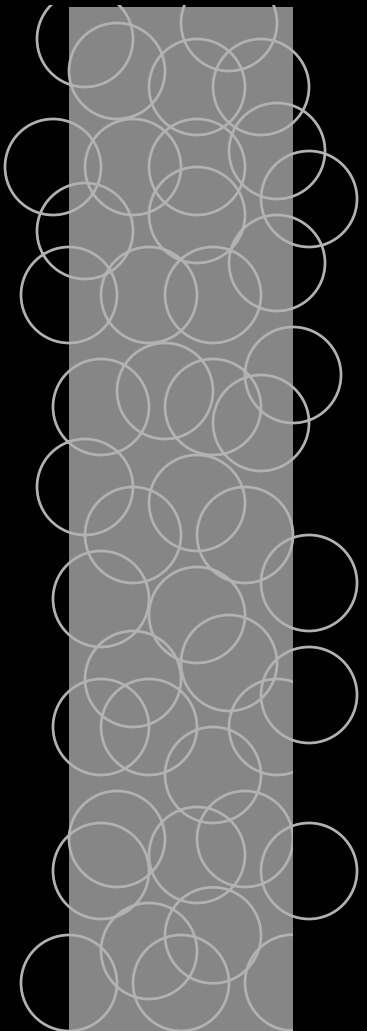


Record Crash Events

- 
- ◆ Extrication Information
 - ◆ Patient Position
 - ◆ Eyewitness/Patient Accounts



We Need the E.D. !!

- 
- ◆ Finding CIREN Patients
 - ◆ Record Crash Events
 - ◆ Document Bruises



Document External Bruises



Injury Sourcing

- ◆ Description of all external lacerations, abrasions, contusions

Or better yet



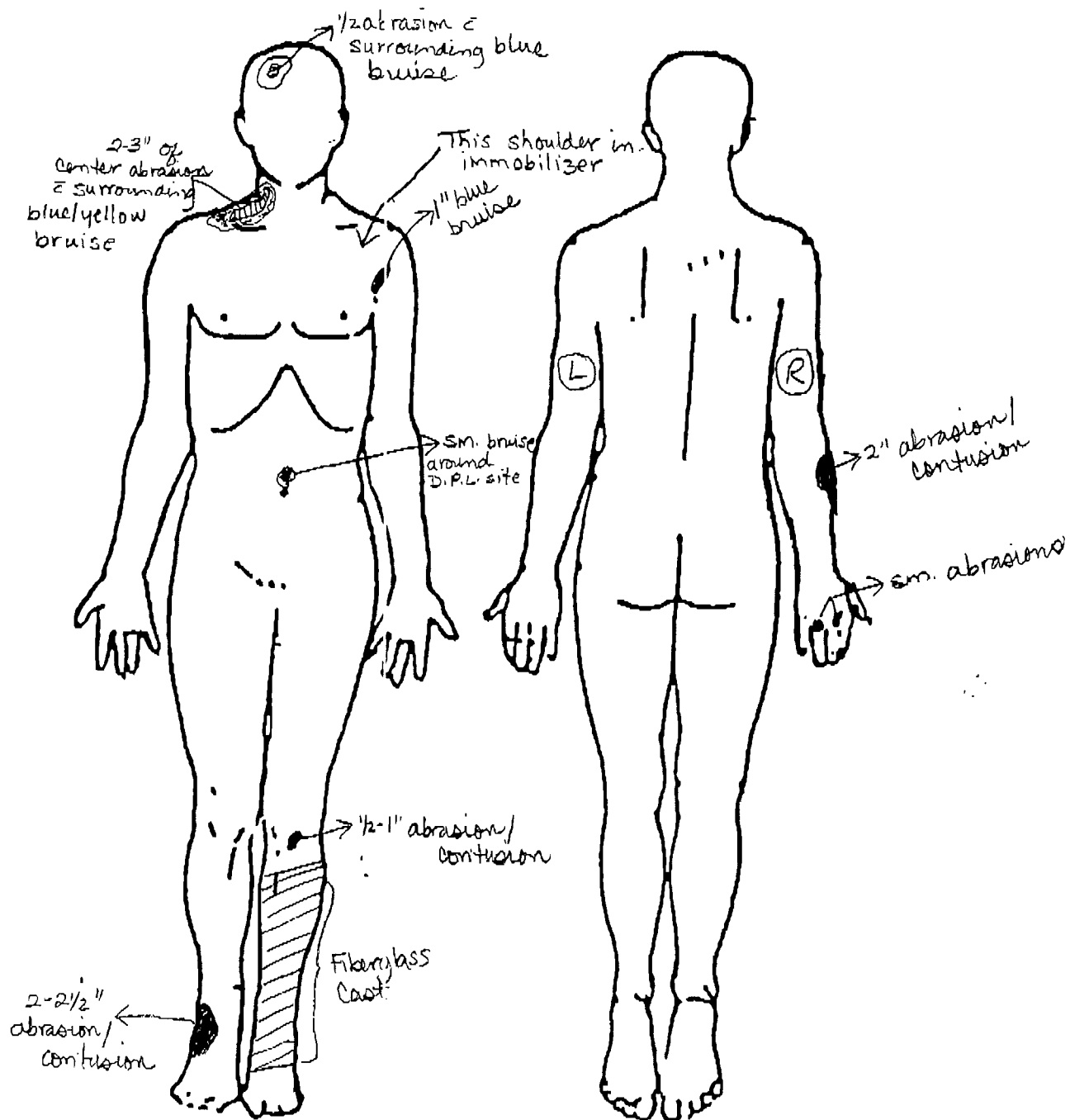


Diagram of Soft Tissue Injuries



The
Living
Proof

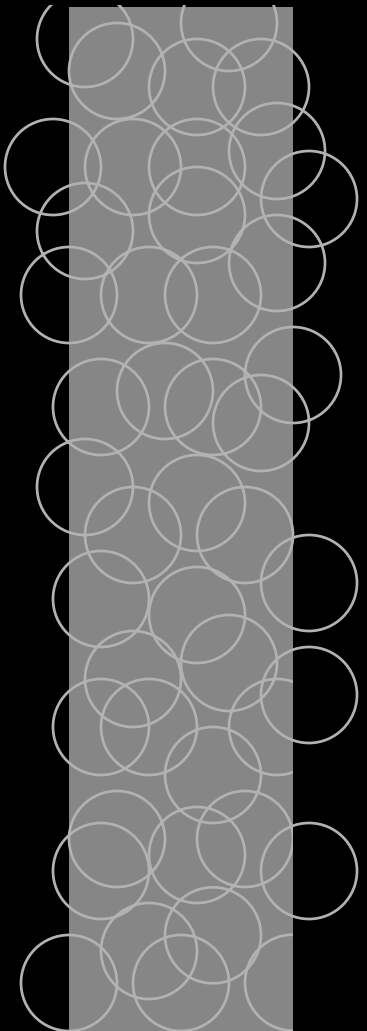


Physical Evidence of Seat Belt Use





All Crashes are Not Created Equal

- 
- ◆ Crash Type
 - ◆ Restraint Type
 - ◆ Body Type

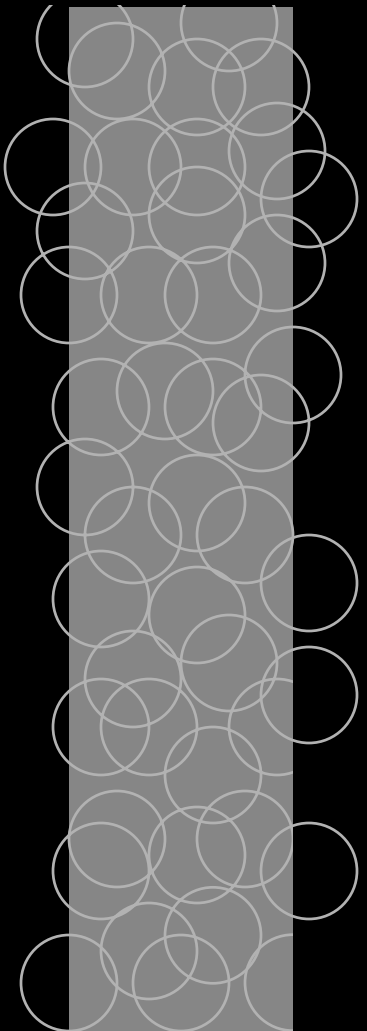


What Have We Learned ?

- 
- ◆ Observations
 - ◆ Injury Trends
 - ◆ CIREN National Database



CIREN “Pearls” & “Perils”

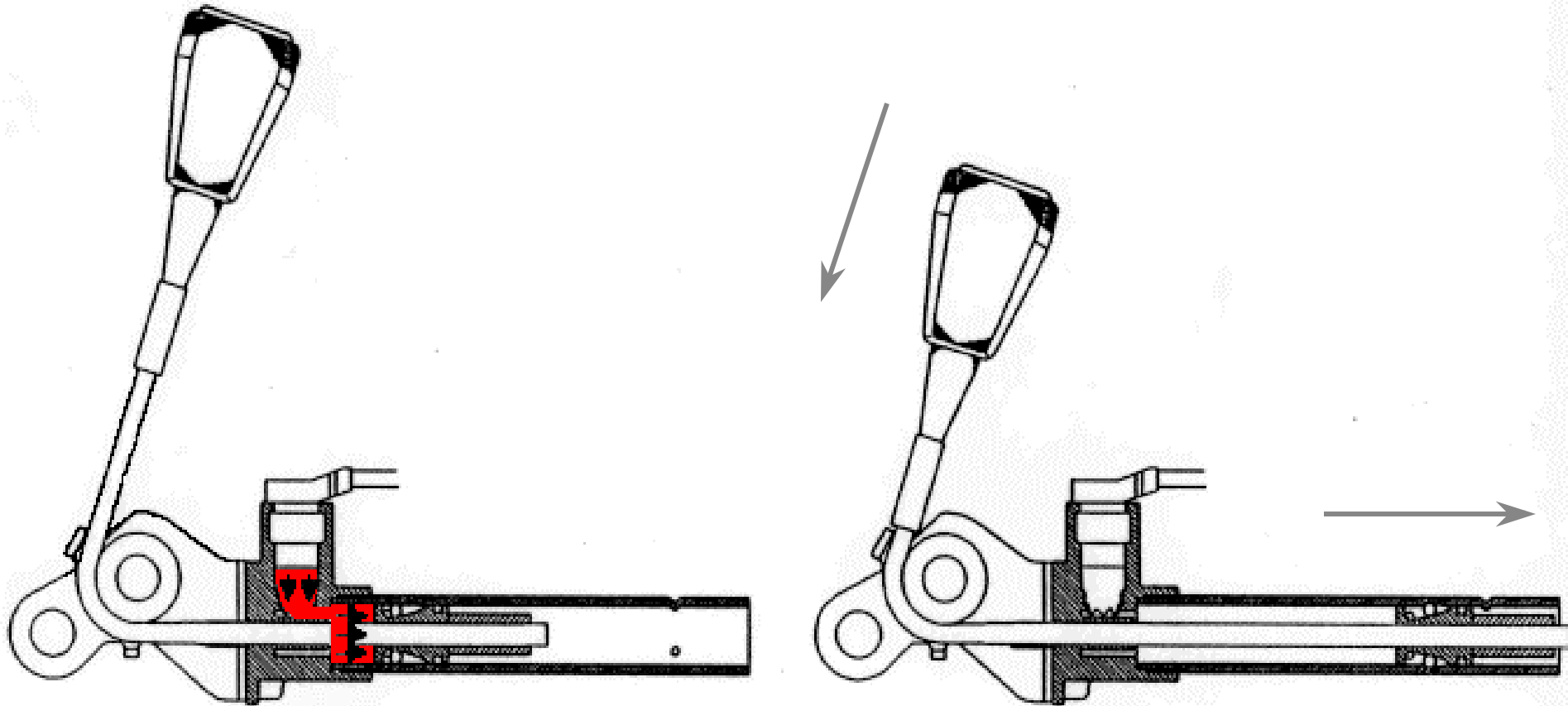
- 
- ◆ Heart/aortic injuries - loading the restraint system
 - ◆ Automatic shoulder belt only in off-set frontal crashes associated with liver/spleen injuries
 - ◆ Seat Belts - Double impacts
 - ◆ Seat Belts - Occupant Loading



New Technologies

- 
- ◆ Belt Pretensioners
 - ◆ Redesigned Airbags
 - ◆ Side Airbags
 - ◆ Electronic Data Recorders

Buckle Pretensioner



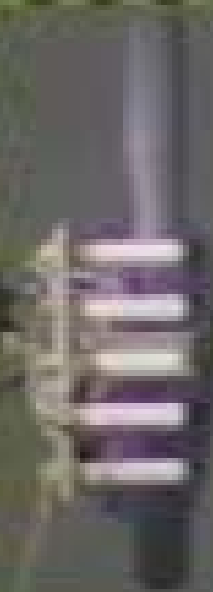
IGNITION
DEPLOYMENT

Safety Belt Retractor Pretensioner



23

January
1912
KAMMOOT



THE
KAMMOOT
1912

Side Air Bag Design

- ◆ Door mounted
- ◆ Seat mounted
- ◆ Roof rail mounted



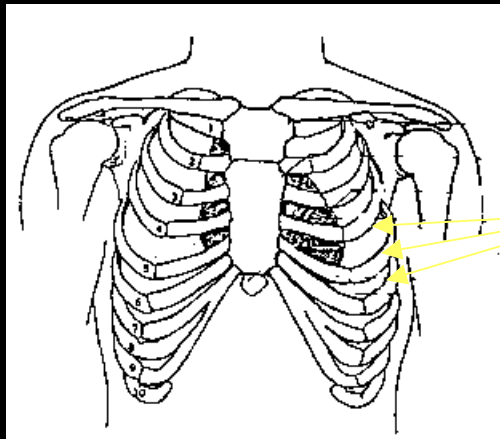
SCI Review & Findings

The Injury Mechanism

– Location of Injuries

◆ Injuries

- Closed fracture 6, 7 & 8th left lateral ribs (3) with left anterior pneumothorax
- Abrasion left lateral chest
 - Crushing injuries are typically contusions
 - Swiping injuries are abrasions



Exemplar Vehicle and Occupant

SCI Conclusions

- ◆ The side air bag is the injury mechanism.



2000 Audi TT





Relevant Intrusions:

LF Door Panel -
17 cm

LF “B” Pillar -
10 cm

LF Front Seat
Back - 4 cm



Exemplary '98 Ford Explorer

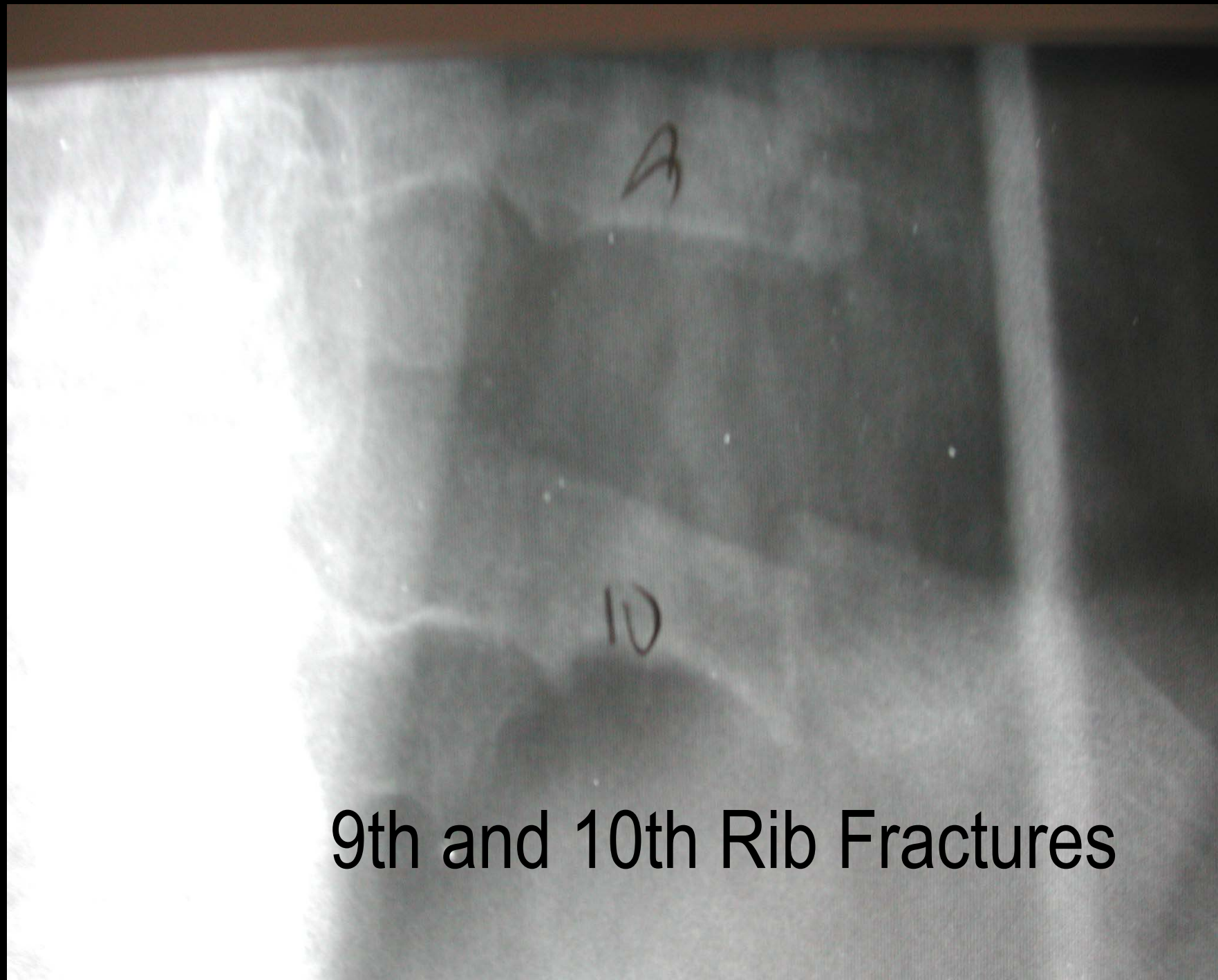
Front Plane Profile

Hood Edge Height
approx. 95 cm

Bumper Height @ top
approx. 65 cm.

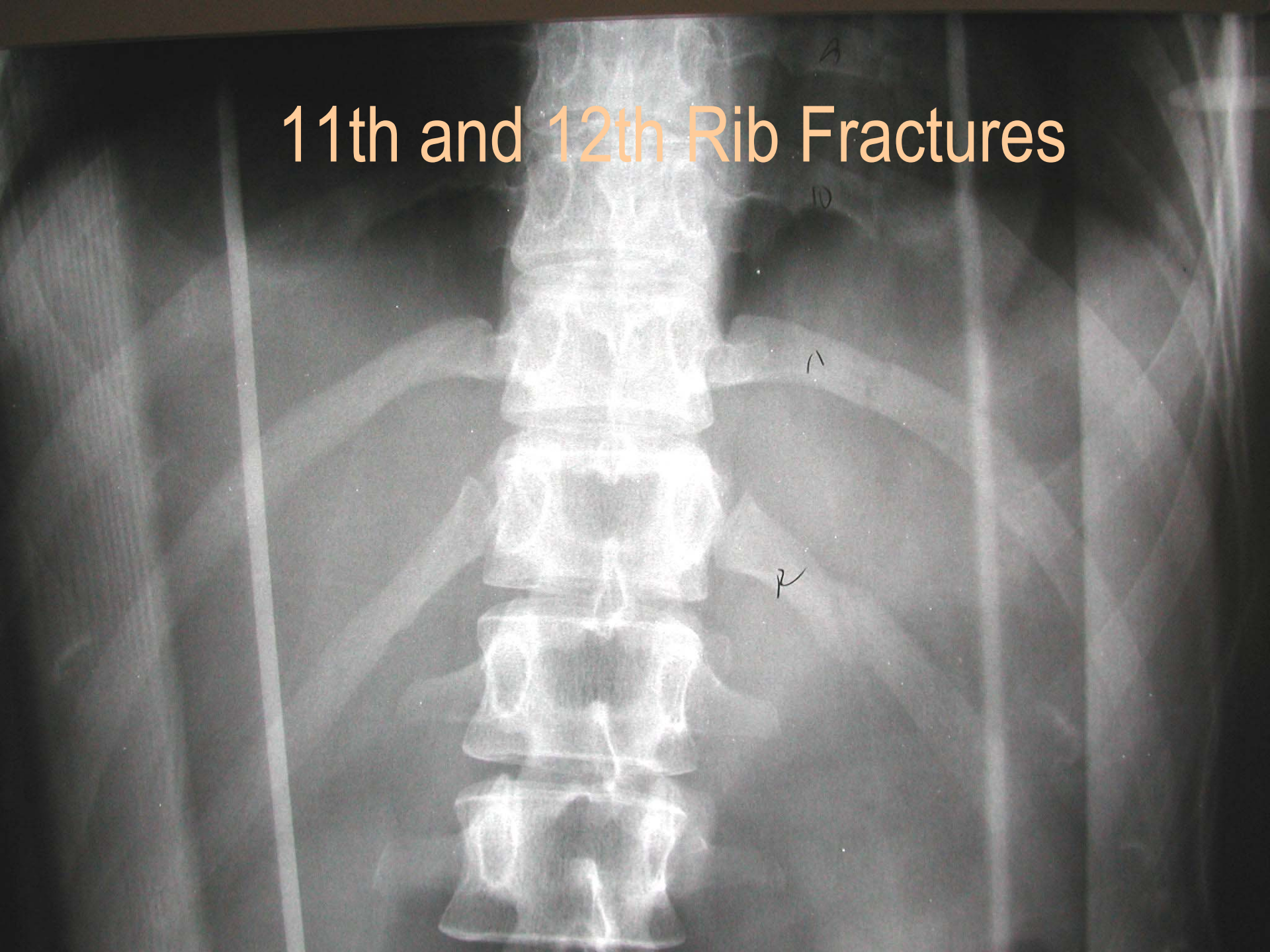
2000 Audi TT Occupied By Same Height Driver



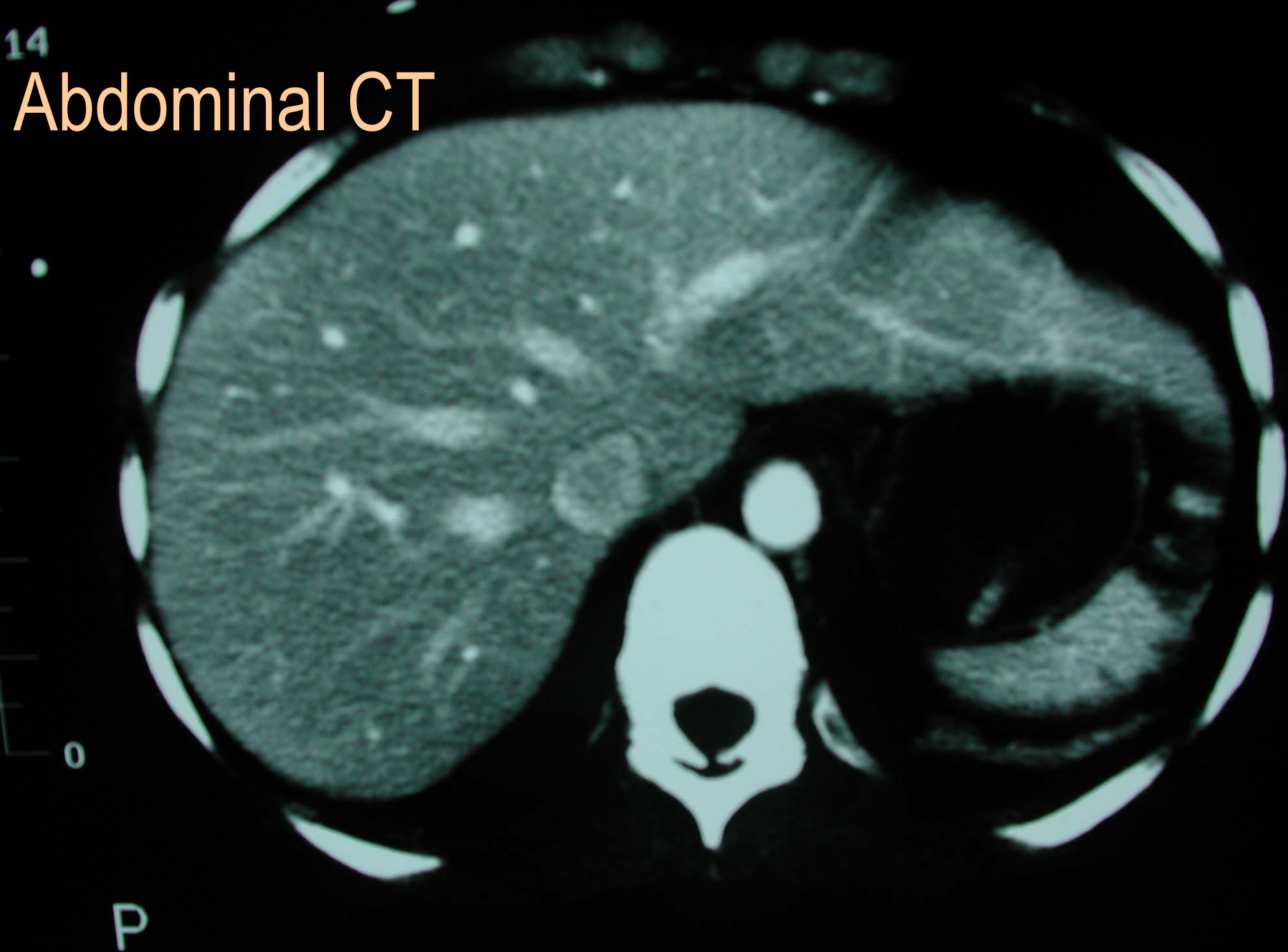


9th and 10th Rib Fractures

11th and 12th Rib Fractures



14
Abdominal CT





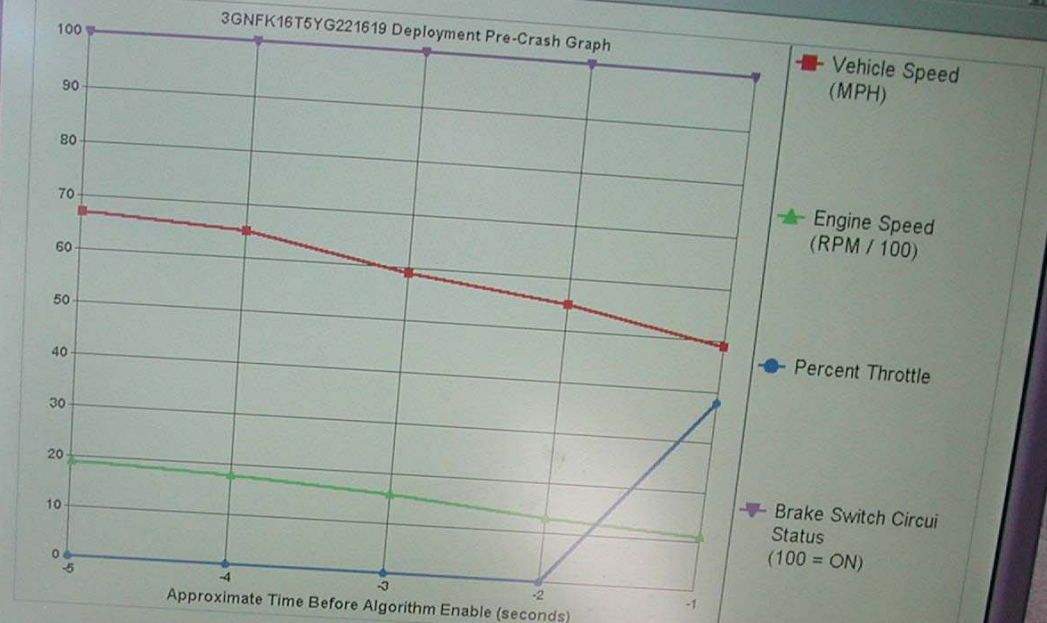


Without HPS



With HPS

Crash Data Recorder



File loaded

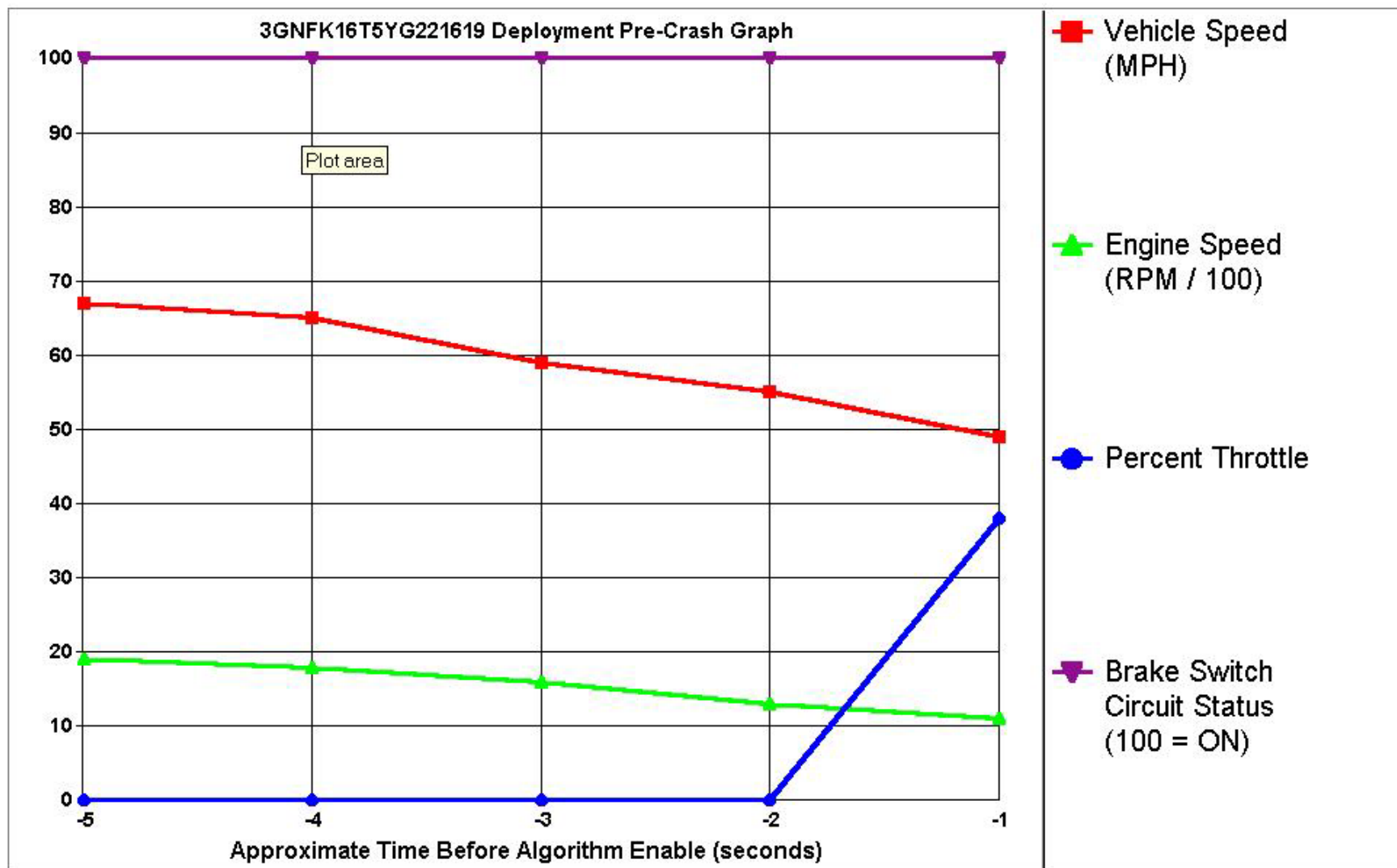
Start | Valtronix Crash D...

Events: DEPLOYMENT | NO Interface

3:00 PM

WinBook XL²





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